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Energy in Housing and Community Development

Report of the Fifth HUD/DOE National District Heating and Cooling Conference

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Introduction

The fifth annual HUD-DOE district heating and cooling (DHC) conference was again successful in bringing together participants actively involved in developing systems in the United States and around the world. The overall theme of the conference was "Attracting the Private Partner", and the trend of public and private partnerships in planning and creating viable district heating and cooling systems was evident. In fact, the belief expressed by many conferees was that the turnaround for DHC in America had finally arrived. No longer was DHC the by-product or unfortunate stepchild of the large investor-owned utility industry. In just five years major strides have been made to develop a stand-alone industry through the pioneering efforts of many public/private entrepreneurs. A number of these successes are presented in these conference proceedings.

The recent OPEC production and pricing agreement and the subsequent price increases should serve as a not-so-gentle reminder that the energy crisis is still alive. The inherent advantages of DHC as a proven technology that provides fuel flexibility, energy efficiency, price stability, and as a catalyst for economic development and long-run independence for our cities are becoming known; the "time is right" for a surge in growth. While much has been accomplished, there is much yet to do before DHC realizes its full potential as a healthy, viable component of the U.S. energy marketplace.

DHC has not been sold as other products and services have in this country. In Europe, for example, where district heating is already commonplace and is expected to more than double by the year 2000, extensive product lines have been developed to market services to all levels of consumers. Much more is needed in the areas of product and service development and marketing in the U.S.

A significant shift that has occurred in the past two or three years in DHC development activities was also noted in the conference. A decade ago DHC was viewed either as an economic disaster for investor-owned utilities, or a "Scandinavian curiosity". Government grants sustained local projects that were comprised mainly of public sector planners and administrators. The private sector entrepreneur was nonexistent. Following a few groundbreaking successes, the direction has changed. The private sector is now being viewed as the aggressive partner that initiates communication and gets things done. Along with this activity the time to put a start-up DHC project into operation has shrunk to as little as two years if local conditions are right for development.

Entrepreneurial success has recently been especially noteworthy in the buying of old utility steam systems from investor-owned electric and gas utilities seeking to divest themselves of a small but worrisome part of their operations. By focusing on the "business" of district heating, these entrepreneurs have been successful in stabilizing and turning around several downtown district heating systems into profitable ventures. While this new ownership of older systems is an exciting occurrence, a sure sign of improving health in the U.S. DHC industry will be to see entrepreneurs active in a wide range of new system developments, and expansion of existing systems into new market areas.

In the area of financing for DHC systems, experts reporting at the conference do not foresee significant negative impacts on DHC resulting from the new tax laws. DHC remains eligible for tax-exempt

financing, but the "cap" in the level of state Industrial Development Bond financing has been reduced so that approval within individual states will become more political. The recent lowering of interest rates has had a beneficial impact on DHC development, and financial markets appear ready to fund sound economic projects with both debt and equity.

Municipal solid waste plants and DHC systems make a good marriage, and the benefits of both can be compounded if local conditions are right. However, combining solid waste system development with district heating system development introduces additional technical, financial, and operational complexities. Strong and persistent political leadership becomes essential for successful implentation.

Many European countries, China, and Korea are continuing to actively pursue DHC development. In Sweden, the trend is toward lower temperature water resource technology with large scale heat pumps. This technology shows promise and could find extensive application in the United States. It is significant that the typical residential consumer in Denmark often pays less for winter heat from district heating than the equivalent U.S. natural gas or oil heat customer.

In addition to the private sector activities, a number of speakers discussed the increasing role of states in promoting DHC development particularly in response to a substantially reduced federal program. The states of Washington, New York, Minnesota, and Michigan have active programs of stimulating feasibility assessments, planning activities, and financing programs. Pennsylvania and Connecticut also are developing state programs and Connecticut has proposed using a share of its oil overcharge funds for feasibility and engineering studies of DHC systems. Many of these state programs have followed the example set by the HUD and DOE Phase I (Feasibility Assessment) and Phase II (Design and Financing) programs.

It is hoped that the broad range of experiences presented in this conference summary report will provide instructive lessons to those contemplating DHC development as part of an overall community economic development strategy. The report format covers each session separately and each speaker's remarks are summarized individually.

SESSION 1: WELCOME AND KEYNOTE

Attendees to the Fifth Annual HUD-DOE National Conference on District Heating and Cooling (DHC) were once again welcomed by Wyndham Clarke of HUD's Energy Division, chief organizer of the meeting. He introduced the theme of this year's multiple sessions as "Attracting the Private Partner" in the development of DHC systems. Clarke noted this theme as most appropriate in recognition of the many public and private cooperative development activities that have taken place during the past year. Many of these DHC project activities would be covered in detail in individual sessions of the conference, he said.

Janice Golec, HUD Deputy Assistant Secretary for Community Planning and Development with responsibility for energy and environment activities, welcomed the conference as an important forum for public and private representatives to gather and discuss ways of forming joint venture DHC partnerships. She termed "Community Energy Systems" as the pathway toward future energy development in cities with substantial private sector payoffs. An important meeting had been held in the fall of 1986 between public and private DHC industry leaders and the staff of her office at HUD, to discuss ways that DHC development could be encouraged under current economic conditions. HUD can be expected to continue its past role of federal leadership in encouraging the development of DHC systems through case studies, transfer of information and experience, and cooperation with DOE in joint research and development program efforts. She thanked the U.S. Conference of Mayors for their active support of district heating and cooling and for their sponsorship of the conference.

DOE's welcoming statement was given by Alan Streb, Deputy Assistant Secretary for Conservation. The focus of DOE's conservation program is on efficiency gains through technology, he stated. Significant conservation of energy resources and reduced reliance on imported oil can be achieved through community energy system integration. This means tying one system to another to achieve maximum energy efficiency. cogeneration and district heating and cooling systems are prime examples of this concept. DHC is system integration at a larger, community scale. Like Golec with HUD, Streb foresees DOE's role in DHC as continuing to provide planning tools, technology options, and cooperating with HUD in workshops and conferences. This cooperation has produced over 55 DHC feasibility assessments in the last five years.

The first keynote speaker for the meeting, John D. Kuhns, was introduced by Floyd Collins, Program Manager of DOE's district heating and cooling feasibility assessment efforts. Mr. Kuhns is the founder, President, and Chief Executive Officer of Catalyst Energy Development Corporation, a company which sells electricity and steam from power plants located nationwide. He is also involved in other investments and financial activities including serving as the Chairman and Chief Executive Officer of Laidlaw Adams & Peck, an investment banking firm, a General Partner of J.J. Lowrey & Co., and a Director of Municipal Development Corporation.

Mr. Kuhns addressed the conference on the topic of the private investment potential of DHC systems, and began by providing some background on the growth of Catalyst Energy to illustrate that DHC is a good investment opportunity for private capital. Catalyst Energy has grown in little more than two years from revenues of $10 million to $524 million; from assets of $8 million

to over $7 billion; and from 7 to over 500 employees. The company has 26 major facilities in 20 states involved in electric power production and district heating. Catalyst Energy is now the largest of 10 public "independent" power companies in a growing field that includes many smaller "private" independent producers. A subsidiary, Catalyst Thermal directed by President Carl Avers, owns and operates Central District Heating Systems in Youngstown, Baltimore, and St. Louis, with systems in Philadelphia and Boston soon to be added. The combined annual steam sales of Catalyst Thermal will soon be second only to Consolidated Edison of New York City. Kuhns stated the goal of Catalyst Energy is to be the highest quality, most profitable independent company providing heating, cooling and electrical services in the U.S. energy marketplace.

Kuhns discussed the criteria that he believes make DHC an attractive investment opportunity. They fall into two broad categories: (1) conceptual, and (2) financial. Conceptual attributes include the fact that DHC is not a new business concept that the financial community must understand and digest. These systems have been operating for decades, and new technology options are now available to improve and enhance their operations. Thus, DHC does not represent a substantial technology risk to the financial community, Kuhns stated. DHC systems also enjoy an inherent practical efficiency superiority that in most cases results in a better and cheaper way to produce and supply heat, benefitting both investor and customer. Environmental superiority is another conceptual attribute and, in the case of existing systems, there are little or no construction risks. Kuhns also pointed out that, on the local level, DHC systems seem to enjoy a less constraining regulatory environment because higher quality service can usually be provided at lower cost. Finally, DHC systems typically sell thermal energy to the retail market; an advantage over electricity sales which are usually made to the wholesale market. Electricity sales are currently being squeezed because of the excess capacity existing at many investor-owned utilities.

Kuhns broke the financial criteria into three parts: (1) buy right; (2) finance right; and (3) own right. By "buying" right, Kuhns referred to the five systems that Catalyst Thermal has purchased from investor-owned utilities. Typically, utilities do not want to be in the DHC business. Their systems are old and largely depreciated. Therefore, in a regulated environment where earnings are dependent on the value of the rate base, DHC has become a losing proposition. Further, the electric side of most utility businesses has grown to dwarf the DHC business. For these reasons, electric utility companies usually are willing to sell DHC assets at an attractive price. A prospective purchaser, cautioned Kuhns, must be credible and be able to continue to operate the system on a reliable basis. Catalyst Thermal has been fortunate in being able to establish its credibility during the past two years.

The experience of Catalyst Energy shows that there are sufficient investors available who are interested in financing DHC systems. According to Kuhns, this is because these systems have a diverse customer base with positive historical results. Debt financing carrying a BAA rating with interest rates in the 10% range is available in today's market. Equity financing is also available - Catalyst Energy has sold four offerings of common stock in two years. Kuhns stated that recent tax law changes have been good for DHC since a higher premium is now being placed on predictable cash flow and earnings by the financial community.

Kuhns believes that DHC systems are stable business opportunities with growth potential. An investment in DHC is an investment in the growth and revitalization of America's urban areas. Further, a good entrepreneur has the opportunity to cut costs and enhance DHC revenues. Cost cutting can be achieved primarily through fuel integration such as that taking place in Baltimore where cogenerated steam from a refuse-to-energy plant is being supplied to the DHC system. Revenue enhancement is a particularly fertile area, with new products and new forms of services from DHC system being developed and service areas being expanded. DHC has not been actively marketed in this country like many other products. Kuhns asserted that this needs to be done, and can produce surprising results.

In concluding, Kuhns related the state of DHC to that of cable television in its infancy. Many assets are fixed; the entrepreneur must figure out how to increase the customer base and products sold. There are 65-70 existing systems with very low operating-to-capacity ratios. While there is a current "flatness" in the independent power industry, Kuhns thinks this is only a temporary situation. For the first time, he stated, there now exists an independent power sector with substantial capacity to supply electricity and heat to the U.S. energy market.

Wyndham Clarke introduced the second keynote speaker, Brad Chase, the Undersecretary of Energy for the State of Connecticut. Mr. Chase was asked to address DHC development from the public sector perspective. As administrator of the state's energy policy, Mr. Chase said he is seeking to take advantage of every available opportunity to manage energy wisely including the use of renewables, cogeneration, and DHC. He sees the trend to larger remote power stations reversing and feels the time is "right" for DHC project development. Connecticut is proud that it has, in Hartford, the state capital and national insurance industry center, the first independent operating DHC system in the U.S. This system, which is currently being expanded to serve a new legislative building and several large insurance buildings, is expected to save $4-$6 million in energy costs over the next 10 years.

Chase cited several reasons why he feels the time is right for DHC development. First is the inherent logic of applying a technology that is energy efficient and fuel flexible, that stabilizes energy prices through investment in local energy infrastructure, that is proven, and that yields economies of scale. DHC systems represent a ready market for the output of waste-to-energy plants, and through use of modern distribution technology, DHC can now economically reach larger service areas. A growing recognition of the systemic aspects of energy - that everything is related - leads Chase to the conclusion that DHC has a vital role to play in the delivery of energy services. Education and the energy crisis have had a dramatic impact on our daily lives, and terms such as "MPG", "BTU", and "EER" are now becoming household terms.

It is this recognition of interrelatedness that requires adjustments in priorities and an active interplay and melding of public and private interests to achieve the maximum benefits of DHC. DHC is a vital part of the strategy in Connecticut for meeting energy policy goals of conservation, diversification, replacement of vulnerable fuels, and providing for low income services. The state has recently allocated $400,000 from its share of the oil overcharge funds for planning, feasibility, and engineering studies of DHC systems.

Chase concluded with a caution that DHC development is a complex undertaking that has to work

to the mutual benefit of both the public and private sectors. Central energy systems can be attractive if adequate safeguards insure reliability, and prevent system failures. The time is right and grass roots momentum is building. Success depends, Chase believes, on how well public and private sector interests can be integrated to achieve mutual benefits.

SESSION 2: DHC DEVELOPMENT; FEASIBILITY TO PROCUREMENT TO OPERATION

Session moderator Andrew Euston of HUD's Energy Division, introduced the three speakers for this session. Each speaker is experienced in managing DHC projects from planning, to construction and operation.

Garth Limberg, currently with the Salt Lake City Development Agency, was formerly project manager of the district heating system development in Provo, Utah. Salt Lake City currently has a Phase I feasibility study underway to assess ways to revitalize and expand an existing downtown steam system which serves 70 customers. As project manager of both projects, Limburg has had an opportunity to compare two different approaches. In Provo, the second largest city in Utah, an existing 40 year-old municipal coal-fired power plant was used as the heat source for the system. Thus, ownership was under the direction of the City Power Board that administers the local electric system. The opposite is the case in Salt Lake City, where all utilities are investor owned. The city has not been in the energy business in the past and does not desire to be in the future.

Whether under public or private ownership, Limburg emphasized four key aspects of DHC development: (1) organization; (2) size; (3) phasing; and (4) design. An organization of key players that can build community consensus for a project is critical to success, Limburg said. Provo was fortunate to have the Mayor, an active supporter of district heating, as the chairman of the district heating feasibility Assessment Work Group (AWG). In Salt Lake City, an Energy Steering Committee is chaired by the director of downtown redevelopment. The conclusions of the Phase I study will be presented as recommendations to the Mayor. Where possible, the potential DHC developer should be an active participant in the AWG. In Provo, this was the case because municipal ownership was the only option considered. Since Salt Lake City has private ownership as an objective, the project is a city initiative only until a private developer can be identified.

If ownership is public, politics plays a big role in DHC development, Limburg said. Citing Provo as an example, the project plans originally called for system expansion in phases following the original early start project. A new Mayor has since been elected who has de-emphasized public ownership of energy systems. Therefore, expansion plans have been stalled. Limburg believes that private sector ownership is less sensitive to this type of political change.

Relative to the other three aspects of DHC development, Limburg said it is important to scale DHC projects to match the financing capacity of the community. The original DHC project configuration in Provo was 10 times the size that the community could reasonably finance. It is important to size and phase the project initially so that a realistic design is achieved. Limburg emphasized that it is essential to hire good technical consultants who are experienced in the design and construction of DHC systems.

The second speaker was Ishai Oliker, DHC Project Engineer from Burns & Roe Consulting Engineers. Mr. Oliker illustrated the process of DHC development from feasibility to construction with several of his successful projects. Using the City of Chicago Housing Authority Project, he showed how a building-by-building survey was used to analyze anchor heat loads. The most successful way to start a DHC system

development, according to Oliker, is to identify a heat source and several large loads in close proximity; a "heat island" approach. This form of DHC development is easier to implement than large-scale systems, and can demonstrate the potential of DHC to other areas of the community. The goal of phase I feasibility assessments is to a start-up or heat island project and work out needed subsequent development steps.

Preliminary design and financial packaging phases of DHC development were illustrated by Oliker using Springfield, Massachusetts as an example. Springfield sought out a private developer for its system. This takes time, as the city discovered. The city is now starting a small downtown hot water system using an old rehabilitated boiler plant as an energy source, with several municipal buildings and a civic center being converted from steam heat to the hot water system. Expansion is contemplated in $500,000 - $1 million increments, eventually linking the district heat system to a resource recovery facility now under construction. The system, once underway, will be turned over to a developer for operation and expansion when ongoing negotiations are complete. Springfield may be an example of how to proceed with the city starting a core project to prove the concept, and then bringing in a private sector partner to take over operation and additional development of the system.

Municipal ownership of an existing coal-fired power plant was the key in the Jamestown, New York project according to Oliker, who used this city as an example of the final stages of DHC development, procurement and construction. Jamestown also started with a small plant retrofit and hot water distribution system in 1984, with hook-ups to four buildings. In 1986, the system was expanded to 19 buildings. Oliker stressed that delivering an operating system within budget estimates is most important to building customer confidence in DHC. To do this, the developer and consultants must know suppliers, their products, and delivery times. Local labor conditions and subcontractor costs are major factors, he said, that must be identified with confidence to control construction costs. Finally, it is imperative to monitor the operation and performance of the system after it goes on line to show customers how much money they are saving. This is the best marketing device for system expansion, Oliker believes. In conclusion, Oliker stated that his experience indicates that if local conditions in the community are right and a system can be shown to be economic, it can be made operational within two years.

The final speaker on the panel was Tom Casten, President of Trigen Development Corporation and chief architect of the Trenton, New Jersey DHC System. Getting the Trenton system underway in the late 1970's pre-dated the rounds of Phase I feasibility assessments initiated by HUD and DOE in the 1980's, but did utilize a HUD Urban Development Action Grant as part of its financing. This project provided a substantial base of information and experience that could be used by the latter projects. Initiated in the early 1980's, the Trenton system is only now reaching its original design configuration of 10 miles of hot water distribution pipeline.

Casten's presentation was in the form of "Bullet Tips" aimed at those in the audience currently in either a Phase I (feasibility assessment) or Phase II (design and packaging) DHC development project. First, he said, it is important to demonstrate an economic advantage over the competing fuels of oil and natural gas. This must be done either by solid fuel substitution through coal or waste, or through efficiency gains from cogeneration.

A focus on the "load factor", or ratio of the amount of energy the plant actually produces for sale in a year compared to the maximum it could produce, is also important. Most commercial buildings are not "good" DHC customers, according to Casten, because they are only occupied during the day, and have reduced energy demands on nights and weekends. Retail facilities, multifamily residences, hospitals, schools, and industries with process loads will increase system load factor. Central chilling along with off-peak energy storage will also greatly improve load factor. Overall system economics can be substantially improved by leasing existing boilers for backup rather than purchasing them.

Customer contracts are an important vehicle for specifying rates, increase mechanisms, and responsibilities. Casten recommends avoiding demand charges based on peak usage as is the practice with electric utilities. He prefers a fixed rate like a mortgage that reflects the cost to serve each building. If customer financing of equipment is used, he recommends using a variable rate which is 2%-3% cheaper than a fixed rate, or offering the customer a choice. The customer should understand that the risk of fuel price fluctuation is his to bear, but with a DHC system it is more predictable and controllable. Responsibilities for the operation and maintenance of in-building equipment and systems should also be specified to avoid conflicts in the event of failures.

In the area of financing, DHC is still eligible for tax-exempt debt, but new rules on depreciation make the advantage of this mechanism less clear. Typically, 15%-20% equity is required to finance a system. A UDAG is considered equity in the credit markets. If less equity is used, more credit backup is needed. Debt also requires a sinking fund that grows to recover the debt in a specified period of time. If possible, Casten would replace this with a "net-worth" concept, so that cash could be invested in growth of a good system.

Casten's tip for construction is to avoid "design-build" approaches. He says solving design problems up front avoids changes, price escalations, and conflicts down the road. Hook-up dates and penalties equivalent to opportunity costs if the system is not operational on time should be included in the construction contract. Conflict resolution procedures spelled out in contracts can avoid legal disputes and delays. Work rules with unions and overtime rates should be negotiated in advance.

Finally, Casten strongly recommends bringing the chief operator on board early because he has a different perspective than either the designer or builder of the system. This perspective is important since the operator will be living with the system for 25 years, said Casten. Long term contracts with DHC operating firms are preferable because the operator in effect becomes an owner with responsibilities and a commitment to the efficient operation of the system.

SESSION 3. IDENTIFYING ANCHOR USERS

Robert Groberg, Director of the Energy Division of HUD, was moderator of this session. He introduced the first speaker of the panel, Kevin Brown of New York based Cogeneration Development Corporation (CDC). CDC develops, finances, constructs, and operates DHC systems. The Trenton, NJ system was developed and financed as a stand-alone, start-up system that serves much of the downtown and surrounding areas. CDC is currently developing new DHC projects in Atlantic City and Newark.

Brown defined an "anchor" user in terms of an analogy to large shopping malls. Anchors are those large stores such as Sears, Penney's, etc., that draw customers and smaller shops to the shopping center. In similar fashion, an anchor for a DHC system is a large building or facility that has a significant, balanced requirement for thermal energy. "Balanced" is important for DHC because system economics are far better when the plant equipment can be used year round, Brown said.

In addition to a large thermal load, Brown defines an anchor in terms of long term location and financial stability. An industrial user may have a high heat demand but not be financially creditworthy or may be subject to economic cycles, union pressures and the like. Particularly when project financing is used, the credit markets want the project backed by long term contracts with financially stable institutions such as government buildings, hospitals and universities. Prisons make an excellent anchor load because they are a growth industry that is not likely to move.

The Trenton system was helped by the active and ongoing support of Mayor Art Holland. Now each new building is added to the system because developers meet with the Trenton staff to arrange for service. The advantages of avoided on-site boiler room equipment purchase, operation and maintenance costs, and fuel storage are selling building developers on DHC. Often the problem in Trenton is keeping up with the demand for hook-ups.

Brown credits the guidelines established by HUD and DOE in the Phase I Feasibility Assessment Program with speeding the development process in Newark. A two-way "windshield" survey with the local project manager assigned by the Mayor's office helped define the target DHC service area and identify potential anchor loads. Working with the local assessment work group consisting of civic groups, the chamber of commerce, and the private sector has opened doors to over 50 potential anchor loads for detailed follow-up analysis. Success breeds success, said Brown, and the Trenton system has given them credibility in Atlantic City and Newark. Site visits to successful systems help to sell DHC in other cities, so Brown encouraged interested parties to contact him to arrange for tours of the Trenton system and exchange of information and experience.

The second panelist was Stuart Temple of Baltimore Thermal, the owners and operators of the steam district heating system in that city. Temple emphasized that district heating seems to be one of the best kept secrets in the U.S. While everyone seems to think it is a European technology, in fact every city of any size has a DHC system operating in a downtown area; government facilities, military bases, hospital complexes, schools and universities, airports, etc., all usually operating independently of one another. The broader challenge is to begin linking these individual systems into larger

networks to realize the potential benefits of district heating and cooling.

In Baltimore, HUD Phase I and Phase II grants helped get things moving in the right direction. These grants helped bring the benefits of DHC to the attention of public officials and private sector leaders. Baltimore Gas and Electric, who wished to get out of the district heating business, had let the system decline in recent years. Temple's firm purchased the system two years ago and immediately moved to stabilize and turn it around. This has been accomplished, Temple said, primarily through a linking of the steam system to the large Baltimore Municipal Solid Waste Facility as a steam supplier.

A marketing plan for expansion has been prepared, once again using the background information contained in the original HUD studies. Temple urged taking advantage of all previous work such as this in DHC system development. Two expansion areas have been targeted: (1) an industrial area containing several industries with excess boiler capacity; and (2) a dense area of high demand containing a prison, hospital complex, schools and public housing. In the latter area, the public housing facility contains an embryo DHC system that could serve as the backbone of an intertie that could more than double the size of Baltimore's DHC network. It is this kind of forward-looking, innovative thinking that will make DHC grow, Temple believes. The support of top public officials, especially former Mayor (now Governor) Schaefer and his energy council, and the cooperation of HUD and DOE, were instrumental in saving and turning around the district heating system in Baltimore. The makings of anchors exist in every city, Temple concluded.

The third and concluding speaker was Joan Barrali, Special Projects Associate for the Buffalo Development Company, a recent entry into the district heating and cooling industry. Barrali expanded the concept of "anchor" to include people - key individuals whose enthusiasm for applying the DHC concept for the benefit of their city helps to get it off the ground. Such was the case in Buffalo with Mayor James B. Griffin, Barrali said. After a trip to Denmark with city officials and the success in sister city Jamestown, the mayor was convinced DHC could be used in Buffalo and initiated system development with a Phase I Feasibility Study grant from New York's Energy Research and Development Administration. The city hall, city court, and fire station were identified as potential anchors for a start-up system by the Phase I consultants, Resource Development Associates. In addition, two nearby apartment buildings were owned by William Christy who had previous experience in other cities with DHC. He was convinced to convert his buildings to the system by using a $200,000 low interest loan. The $1 million system broke ground in September and even before its scheduled start of operation in February, plans were underway for a second phase expansion, Barrali said.

Moderator Groberg summarized the session by saying that anchors for a DHC system probably exist in every city and that the concept of anchors could be expanded to include those key public and private leaders who are instrumental in getting DHC development underway. In essence, it is a "system" of anchors networked together that is the essential ingredient of a successful project.

SESSION 4: STATE ROLE IN PROMOTING DHC

The moderator for this session was Jerry Duane, program manager for State and Local Programs within the U.S. Department of Energy. He introduced the first speaker, Mr. Gordon Bloomquist, from the Washington State Energy Office.

Mr. Bloomquist cited three major reasons for a state to become involved in a DHC. First, there may be abundant resources of renewable energy that provide an inexpensive source of energy. Second, since energy prices are currently low, a DHC program can be promoted from a position of economic development, revitalization, and economic stability. Third are the environmental factors: air pollution from small boilers is eliminated, and solid waste treatment plants can act as an energy source instead of an energy sink.

The development of a DHC program in Washington began in 1978. The federal government supported geothermal development in Washington because 89 fairly large communities showed potential for a district heating system using geothermal energy. Wells that were drilled in the early part of the century were still flowing artesian water at 80 to 90°F. HUD community development program funding provided $468,000 to the City of Euphrate to develop the nation's first dual purpose domestic water supply system that provides both domestic water and heat. As an incentive to the private sector to enter into DHC development, legislation was introduced in 1983 that would allow the private sector to be in the DHC business with a non-regulated rate of return. In Washington, companies are unregulated in terms of the rate of return, but are regulated in terms of customer contracts, the adequacy of service and the financial where-with-all to develop a project.

States can provide technical assistance for feasibility studies, Bloomquist said. The Washington State Energy Office is developing a computerized technique for feasibility studies called "Heat Plan" that will be ready by the end of March. By the end of 1987 a design tool that will analyze a city for a whole district heating and cooling system using a plotting board and city map will be ready.

Washington State has also been successful in getting about one million dollars of the Exxon oil overcharge money put into DHC feasibility studies; and three and a half million dollars for revolving loans for local government and conservation programs in the industrial and commercial sectors. The majority of the monies set aside by the State Energy Office could be focused towards district heating and cooling in the state.

The next speaker was Mr. Fred Strnisa of the New York Energy Research and Development Administration (ERDA). He provided some general background on the agency, which was created in 1975 to foster the development and use of safe, dependable, and economic energy resources and to foster energy conservation. According to Mr. Strnisa, close to 11 million dollars was spent last year on energy research and development. New York ERDA's role in district heating and cooling was to provide upfront risk money and to work with appropriate parties to pass legislation to allow DHC projects to go into operation. New York ERDA worked with the Rochester District Heating Cooperative to develop legislation that would exempt it from public service regulation, and also developed a bill which allowed the county the right to join the steam cooperative. Prior to that, New York ERDA worked

with the City of Jamestown on a bill authorizing municipalities to borrow money for district heating and cooling infrastructure. In Syracuse, a Phase I study is being cosponsored with DOE. There is a high probability that this will move into a second stage. The kind of state legislation necessary to enable the county to sell steam to a private building is presently under discussion.

The role of NY ERDA in supplying the upfront risk money for DHC project development is an important factor, according to Strnisa. District heating is very site specific, therefore there is a lot of upfront work to be done before it is known if a project is possible. District heating benefits are not universally appreciated on the local or state level. Funds are provided to find and evaluate a project, to provide the staying power once it is identified, and to move it into construction. Over the past six years, NY ERDA has spent two million dollars on district heating, averaging just over $300,000 a year. It has ranged from $50,000 in 1981 to $700,000 in 1985, and probably $700,000 again in 1987.

New York ERDA follows the example set by HUD and DOE. The objective of the Phase I study is to find good projects by cofunding with the local sites, and to insure that the analysis is sufficient to secure significant local funds for subsequent phases. The second phase is to perform the kind of detailed analysis necessary to finance the project. The third phase is to finance, construct and operate. In the fourth phase, once operation is started, New York ERDA recoups its investment through project revenues for reinvestment in other projects.

To date, New York ERDA has success stories in the cities of Jamestown, Rochester, and Buffalo. Jamestown has had a new district heating system in operation since 1984. Two summers ago they went through a major expansion and installed about 35,000 feet of pipe. They are now selling about 13-14 megawatts thermal. Rochester District Heating Cooperative was formed a little over a year ago. They took over a system which had been operated by the Rochester Gas and Electric Company. Buffalo started construction of a system this fall. They recently started providing service to city hall and by the end of the month they will be providing hot water and steam service to five buildings in downtown Buffalo. The load in those five buildings is comparable to Jamestown, which is servicing about 19 or 20 buildings right now.

Mr. Strnisa concluded by saying that an active state program makes a difference, not only in New York, but in Washington, Pennsylvania, Minnesota, and elsewhere. New York is unique because it has an energy authority which has the resources to build on the HUD and DOE examples. It takes maybe three to four hundred thousand dollars per year to result in two, three, or four successes in a half a dozen years or so. For those states who don't have a program or who would like to build one, Strnisa emphasized using available dollars to perform the Phase I Feasibility studies and using skills to promote the legislation which really could make a difference. If states can find the Jamestown, Buffalo and Rochester's in their states, and the leaders who can make things happen, with a few hundred thousand dollars and a good consultant a district heating program will be underway.

The concluding speaker in this session was Joe Deklinski of the Governor's Energy Council in the State of Pennsylvania. The Energy Council is primarily responsible for energy policy and energy efficiency in Pennsylvania.

Pennsylvania started in district heating and cooling a couple of years ago during the update of their energy policy. The original energy policy was put together in 1980. As they started to update their energy policy, two of the six existing DHC sites said, "Why don't you do something about district heating?" Pennsylvania then made a cursory review and realized that there was probably a lot more needed than a phone call to find out what was going on. Sixty-thousand dollars was awarded to make an assessment of DHC potential in Pennsylvania.

Three things were looked at in the assessment. The first was to find out how many existing DHC sites there were, what they looked like, and what were their problems. The second thing was to identify abandoned sites and determine why they were abandoned so that the same mistakes weren't made twice. The third thing was to review the potential for district heating in Pennsylvania. An aside to the whole process was the development of a District Heating Guide Book for communities that were interested in putting together a district heating program.

Some thirty sites were abandoned by gas and electric utilities deciding to get out of the DHC business. It was discovered that there were 37 sites in Pennsylvania that had the potential to foster a district heating program. With that in mind, the legislature and the Governor were approached to allocate money to perform feasibility studies.

One hundred and fifty thousand dollars were granted for the initial program; an RFP was issued, and six proposals were submitted. With an additional $64,000, all six proposals were funded. Three cities, one borough, and two counties are currently looking at district heating and the reports should be complete on June 30, 1987.

Pennsylvania is very pleased with the results of these studies and is planning to create a District Heating Advisory Committee to continue to foster district heating in the state. Pennsylvania is also looking at the possibility of using Pennsylvania Energy Development funds to continue to help cities go further in their development of district heating and cooling.

SESSION 5: LUNCHEON SPEAKERS

The luncheon program was introduced by Stuart C. Sloame, Deputy General Counsel at HUD and formerly Deputy Assistant Secretary for Planning and Community Development. He introduced Carl Avers to present the 1987 Norman Taylor Award. Mr. Avers, President of Catalyst Thermal, was the 1986 recipient. To set the context for the award, Avers gave a brief state-of-the-industry view from his perspective as a DHC developer in the private sector. DHC, he said has been in the position of being the unfortunate by-product or "stepchild" of the large investor-owned utility industry. Now, times are changing and in the past two years major strides have been made to develop an independent industry through the pioneering efforts of many public/private entrepreneurs. The importance of DHC systems as a fuel efficient, flexible, and low cost energy delivery system is known in most European countries. Avers cited the city-wide system in Paris which is supplied by a combination of waste-to-energy plants, coal-fired boilers, and geothermal sources.

Avers suggested that the Norman Taylor Award is like the "Oscar" of the DHC industry. It is an award that recognizes the efforts of those who have contributed much to give the industry its identity and put it back on a growth curve. Such has been the nature of the efforts of the 1987 recipient, Wyndham Clarke, manager of HUD's District Heating and Cooling Program for the past several years.

Following brief acceptance remarks by Mr. Clarke, Sloame introduced the featured luncheon speaker, the Honorable Bill Green, Congressman from New York City. Mr. Green opened his remarks by stating that while he didn't know the technical details of DHC, being from New York City he did know that it is an efficient form of energy delivery. Consolidated Edison of New York owns the largest steam district heating system in the United States with annual sales of 30 billion lbs, 80% of these sales are produced using cogeneration. Steam is still economically competitive in New York City as evidenced by the number of new buildings, such as the IBM building and Marriott Hotel, opting for DHC service. Con Ed is now recommitted to its steam system, with a new investment program to refurbish and expand the service.

Green stressed the importance of continuing a strong energy conservation program as an important part of long-term U.S. energy policy. In Congress, he has advocated many such efforts, including the Energy Conservation Bank. He cited recent OPEC agreements and the subsequent rise in oil prices as evidence that the energy crisis is not over.

Green praised HUD for its DHC efforts which, with a modest budget, has resulted in 5 completed projects with $14.8 million invested and 7 more expected to obtain financing and begin construction with an additional $163 million in anticipated investment. This is almost a 200:1 return on the federal investment.

One of these projects is in New York, the old Brooklyn Navy Yard abandoned after Wold War II. For some years, the city had been planning an industrial park on the site. A DHC system linked to a waste-to-energy plant has been proposed serving the site plus 5,000 units of nearby public housing. In the public housing facilities alone it has been estimated that $3.5 million in boiler replacement costs and $900,000 in annual heating bills could be saved.

It is projects such as these, Green noted, that have been identified by the steps in the process of DHC feasibility evaluation. By combining heat sources with customer service areas, promising DHC concepts can be developed and economic trade-off analyses performed. Since a DHC project in an urban setting is a complex blending of diverse interests, Green observed, HUD has wisely required setting up an advisory group of local representatives as a forum for building consensus and support for the effort. This process is now paying dividends in New York City as the promising Brooklyn Navy Yard DHC project is about to emerge.

In conclusion, Green reiterated his concern that the energy crisis will not go away. He believes, and this has been his experience, that with proper configurations of heat sources and customer service areas, DHC will be an increasingly vital and growing part of U.S. energy supply strategy.

SESSION 6 (PLENARY): ATTRACTING THE PRIVATE PARTNER

Introducing the plenary session speakers was Mr. John Millhone, Director of the Office of Buildings and Community Systems within DOE. This office conducts DHC research, investigating ways to make energy efficient, cost effective improvements in DHC systems components through technology advancements. Current DOE-funded projects in this area include low cost heat meters, and fluid additives to reduce pumping costs and enhance energy-carrying capacity. For several years DOE has sponsored, with HUD, Phase I Feasibility Assessment projects.

Millhone noted that in the years since he was Director of the Minnesota Energy Agency, the character and nature of DHC development has changed dramatically. In the early years, the thought of DHC as an attractive investment for private capital would have been revolutionary. The few new DHC development activities being undertaken were sustained primarily by government grants and staffed by local public-sector planners and administrators. Following a few groundbreaking successes from early projects, the direction has now changed. The private sector is viewed as a strong active partner that is initiating projects and is getting things done. Thus, Millhone concluded, the focus on attracting the private partner is very appropriate for this year's plenary session.

Millhone introduced Tom Casten, President of Cogeneration Development Company (CDC). An item of news interest was also announced as Casten's firm has been merged with a $3 billion French company to form Trigen Energy Corporation, with the resources to actively seek and develop district heating and cooling opportunities in the U.S.

Casten believes that private firms such as his offer several appealing things to cities interested in DHC development. First, they offer management talent and resources with the expertise and experience required to make the development of a system happen. Over the years CDC has built a team with the capability to deal with the myriad of complex technical, legal, regulatory, and institutional issues that must be resolved in any DHC project. Since its inception, CDC has had a lawyer on its staff experienced in PURPA, customer contracts, financing, local ordinances, etc. It has also built up an experienced group of DHC plant management and operations personnel.

Secondly, and Casten believes equally important, is the 100% focus on "the business" of district heating and cooling offered by firms like his. Many steam district heating systems in this country owned by investor-owned utilities lack this emphasis because steam sales are only 1-2% of revenues. DHC development requires a company policy and personnel dedicated to making it happen.

A third tip to communities seeking to attract a private DHC developer is to minimize the development time required for the project. Since it requires considerable time to develop the community consensus needed to go ahead with a project, this needs to be accelerated to attract the interest of an entrepreneur. A two or three year "study" process is not interesting in the age of DHC renaissance, said Casten. His firm needs to know that a city is serious about going ahead with a project. Therefore, he recommends a "qualifications" approach to soliciting a private partner rather than a "bid" approach. Once one or two firms with appropriate

qualifications have been identified, negotiations can proceed. This is more desirable since DHC development is not a cleanly defined, packaged project but a complex planning and design process that will change many times before reaching its final state. In using the "bid" approach, Casten believes cities are often looking for free studies without a real commitment to a project.

Casten's firm is looking for opportunities to take an existing system and improve its efficiency while also utilizing solid fuels to obtain cost reductions. Existing coal-fired and refuse-fired plants that can sell cheaper Btus are ideal, he said. However, he normally avoids situations where resource recovery and district heating development are coupled, since the siting of waste plants polarizes a community. DHC by itself, if it is economic, has benefits enough for everyone. Therefore, local bi-partisan support, or at least political neutrality, can usually be gained because it is on the "right" side of most issues such as energy policy, housing, and urban economic development. Controversial and especially back-door dealings are avoided by Casten's firm. In addition to efficiency and solid-fuel substitution gains, Casten believes that long-term growth and expansion potential must exist. Starting with an existing or small system is fine, but a true entrepreneur seeks long-term growth as an additional inducement to undertake development of a project.

In summary, Casten sees the U.S. DHC industry growing significantly in the years ahead, with many profit-making opportunities available to the private sector.

The next plenary session speaker was Terrence Moan, Deputy Commissioner of Real estate for New York City. In this capacity, he is the "landlord" for 20,000 pieces of city property. for the past four years he has also been the public sector sponsor of the Brooklyn Navy Yard (BNY) cogeneration DHC project. The BNY project, which has an existing operating steam loop operated by a private developer, has the growth potential to serve an industrial park development, a shopping center, and 5,000 units of public housing. While these ingredients of a successful project existed from the beginning, Moan has supported five feasibility studies, each with a different configuration in an effort to anticipate criticism of DHC opponents.

Because of fluctuating fuel prices and a 12-month budget cycle, the city budget office always looks at the worst-case scenario with a "Can we get it cheaper elsewhere" attitude. In this type of environment, a DHC project must build a constituency outside of the budgetary process. In the case of the BNY project, it was allied with public housing and economic development goals. Now it is beginning to look like the BNY project will be a success story. Moan gives partial credit to HUD for supporting it through Phase I and II studies.

Moan concluded by saying that the public sponsor role he has played is a difficult one that requires keeping the lines of communication open between public and private sector parties. This is particularly true with the financial partners who cannot understand why the political process is slow when a closing is eminent.

To summarize the plenary session, John Millhone indicated there are three types of development situations: (1) start DHC from scratch; (2) rehab and build on an existing system; and (3) some mix of the two. He asked each speaker to comment on the "health" and prospects in each category. From Tom Casten's own perspective of having started a system from

scratch, he believes the lead time before revenues begin is far too long to see much private sector activity in that category. Therefore, as examples in Baltimore and Jamestown show, the activity of the future would seem to be in the latter two categories. Moan indicated that something has to form the basis for a project - a stable anchor customer(s) such as a school or hospital and/or an existing heat source. Something has to provide revenues next year- not five or six years down the road.

Millhone concluded by saying that while there are signs of an increase in private sector DHC development activity in the latter categories, and that is good and exciting, more balanced and broad-based support is needed before he sees DHC realizing its growth potential as a widely used energy system in the United States.

SESSION 7. DHC ECONOMIC DEVELOPMENT CASES: STARTERS

Bernard Manheimer of the Energy Division of HUD moderated the session. He commented that HUD interest in DHC stems from an economic development perspective since HUD administers the Community Development Block Grant and Urban Development Action Grant Programs. HUD also pays annual utility bills of over $1 billion for public housing and Section 8 housing. Manheimer said that a recent study has shown that energy is a primary factor in location decisions by corporations.

The first speaker for this session was Tom Bovitz, General Manager of the Hibbing, Minnesota Public Utilities Commission, which administers electric, water, natural gas, and steam services for the city. Hibbing has had a steam DH system since the turn of the century. A coal-fired municipal power plant with a cogeneration unit is the source of steam for the system. Currently there are 78,000 linear feet of pipe serving all classes of customers including single family residences at a price of $7.50 per million Btu.

In September of 1984, Hibbing was awarded a HUD Phase II Preliminary Design and Financing Grant to study expansion of the system to a new industrial park called Wood Park. It was being developed by the State of Minnesota to help offset the economic depression caused by the loss of the iron ore industry in the area. The study also explored expansion into an area containing a junior college, shopping center, and other customers, and into a residential area. The payback to the residential area was too high (greater than 20 years) to warrant expansion, but the other two areas were in the 10-15 year range so the city decided to go ahead with new lines. A $1.0 million, 2600 foot line to the junior college and shopping center and a $1.3 million 3/4 mile line to Wood Park have been constructed. Additional residential customers were also added along the pipe route. In addition, $1.3 million per year has been expended for the last three years to refurbish the power plant boilers and existing steam lines. The city is currently working at steam-to-hot water converters at the end of the steam lines to push service into other areas.

Bovitz believes that energy supply was a primary consideration along with the availability of aspen wood, for a chopstick manufacturing plant to locate in Wood Park. Eventually the city hopes to burn wood residue from the park and possibly peat as additional indigenous sources of fuel for a fluidized bed boiler.

The second panelist was Rita Norton of San Jose, California. Norton is the Energy Program Manager for the city, in the Office of Environmental Management, reporting to the Environmental Committee of the City Council.

San Jose began its program with a concept of developing a "superblock" which could be served by a small scale, natural gas-fired cogeneration plant providing electricity and chilled water. The city received a HUD Phase II Preliminary Design and Financing Grant in 1984 to study the first superblock configuration serving two hotels and a library in the downtown area. A 1.5 megawatt system was designed for the area as a result of that study and the city decided to move ahead with the project without realizing all of the implications of being new in the energy supply role.

Subsequently, Pacific Gas

and Electric Company, the electric utility, recognized a potential loss of market share and offered to negotiate lower electric rates if the city would cancel plans to go ahead with the project. Therefore, the city has placed the project on hold.

As a means of establishing a firm commitment, an Energy Master Plan with broader long range goals is being drawn up. Community-scale energy systems are a part of the plan, but it also recognizes that building design, siting, and orientation are elements of an overall energy management program. Linking of superblock systems and solid waste utilization are long term components of the plan. It will also provide the basis for a sound analysis of cogeneration alternatives, an evaluation of PG&E's alternatives, and an evaluation of PG&E's buyout offer which would have to be approved by the Public Utility Commission. Finally, the plan proposes strategies for funding energy planning such as using part of the oil overcharge money or a portion of the city's 5% utility tax.

The city has received a DOE Phase I Feasibility Assessment Grant to study two additional areas for district cooling service: (1) a Silicon Valley redevelopment area, and (2) a new industrial development. It is hoped that these studies and the Energy Master Plan will result in leveraging $4.5 - $17 million in construction in the next few years, Norton concluded.

The final panelist was Joseph Superneau, Director of the Department of Public Works in Springfield, Massachusetts. Like San Jose, Superneau said, Springfield did not have a DHC system to build on and was starting from scratch. The city received one of the original HUD Phase I grants in 1981 and subsequently was awarded a Phase II grant to study the DHC potential in the city. These studies identified the downtown area, which had undergone extensive revitalization, and two surrounding areas as potential candidates for DHC service. Heat sources were a municipal solid waste plant being constructed across the river, and a new gas-fired cogeneration plant downtown.

After several iterations, including a change in mayors, the system development strategy appears to be moving into focus, Superneau said. Since the city did not want to be in the energy business, a private DHC developer was selected. Negotiations to sell the old civic center as part of a $20 million office-home-convention center are being finalized. The developer of the complex is willing to become a customer of the DHC system. The cogeneration plant may be located in the civic center and also owned and operated by the developer. If the long-range option of supplying heat from the municipal solid waste plant across the river materializes, the cogeneration plant will be purchased at cost as part of the expanded system. The original start-up system is planned to serve six downtown buildings in addition to the new complex, Superneau said.

SESSION 8: CITY/OWNER NEGOTIATIONS

A number of different perspectives and experiences on city and private developer negotiations were presented by the four panelists in this session. The speakers were introduced by moderator Charles Williams, Director of Energy Management for the City of Chicago.

The first speaker was Paul Mydler of the Bi-State Development Agency in St. Louis, Missouri. Mr. Mydler, who is the Director of Special Projects for Bi-State, began by explaining how his agency, which is somewhat like a port authority in both the States of Illinois and Missouri, happened to be in the district heating business. Because landfills were becoming a problem and incinerators were old and obsolete, the Agency was commissioned in 1977 to study resource recovery options. After several studies were completed in 1981, a waste-to-energy plant site was selected near an existing power plant owned by the Union Electric Company.

Union Electric also owned the downtown steam system but, like many utilities wanted to get out of the DHC business. The plant had been converted from coal-firing to oil in 1972. By 1974 rate increases of 35% were experienced and the system lost almost half of its customer load base. Union Electric had proposed building an 8,000 TPD refuse-derived fuel (RDF) plant in the early 1980's to prepare RDF for burning in its power plants. However, a plant of that size proved infeasible and a pilot plant did not operate satisfactorily, so the idea was dropped. Therefore, it appeared that the district heating system was the only major viable energy customer for the resource recovery plant. However, rates had to be stabilized and new customers attracted to make the system viable.

The Missouri Public Services Commission (PSC) was approached with the idea of selling the system to an unregulated public or private entity that could negotiate rates on a long-term contract basis. The PSC wanted assurance that a viable operation would result, so they approved the purchase by Bi-State. The Agency thus replaced the PSC as the overview authority and became the owner and operator of the 22 mile distribution system.

Thermal Resources of St. Louis, a private subsidiary of Catalyst Thermal Energy Corp., was brought in as an agent of Bi-State to purchase and operate the Ashley power plant and subsequently to develop the 1200 TPD resource recovery plant. This plant is currently in the financing state and construction is expected to start later this year. New customer contracts are now in place and system expansions are being planned in three phases.

Many complex public and private negotiations were required to complete this package, Mydler stated. These negotiations resulted in actions by the state legislature and PSC, modifying the Bi-State charter to allow it to own and operate DHC systems; and in agreements and contracts with Union Electric, Thermal Resources, and a large number of customers.

The next speaker was William Hanselman, President of Resource Development Associates. Mr. Hanselman has a wide range of experience in planning and packaging successful DHC projects. His remarks were focused on the Rochester, New York system which was salvaged from abandonment by the formation of a customer cooperative. Rochester had a steam district heating system since 1889, and it went through all the typical phases of cogeneration, conversion from coal to gas, escalation of rates,

and finally a request granted by the PSC to Rochester Gas and Electric, the investor-owned utility that owned the system, to abandon it. The New York ERDA funded one last effort to study ways to save the system. When the private sector developers who investigated the system showed no interest, a group of enterprising customers, spearheaded by Xerox, formed a customer cooperative. Special legislation was passed to allow the cooperative to purchase and operate the system. A letter from HUD to the New York State Legislature outlining the economic development benefits of this action was instrumental in getting the legislation passed.

In 1985, $9 million in bonds were issued and the system was purchased for $750,000. Temporary boilers were installed, and currently a new gas-fired baseload boiler system is ready to go on-line. A key to the success of this approach, Hanselman said, was that the co-op achieved credibility or "standing" in the community through the leadership influence of several businesses, especially Xerox. A second major factor was conceiving a DHC configuration that could be completed within the time and budget limitations of the community, rather than striving for the best or "optimal" system. Now that the system has been salvaged and stabilized, Hanselman believes that the co-op is in a position to address expansion and options such as cogeneration.

The perspective of the private developer was next presented by John Nimmons, attorney and principal in his own law firm. He discussed a project involving a geothermal well developer who was seeking to attract a public partner. A potential city was identified and negotiations were well underway with the Director of Public Works who was enthusiastic about the project and became its "local champion" within city government (Nimmons declined to identify the city as negotiations are still active). The geothermal well developer did not have particular expertise in DHC systems and preferred that either the city or some third party develop that aspect of the project. It was agreed, however, that more detailed information was needed about both the energy content of the well and the heat market.

An agreement was reached whereby the developer would underwrite the cost of the study if the city would commit to buying energy, or at least grant an exclusive franchise to sell if the project proved feasible. At about this time the public works director left the city and a less entrepreneurial director took over, resulting in a scaled-down version of the project, Nimmons reported. A heat sales agreement has been drawn up that spells out responsibilities and commitments with a franchise to expand the system if it proves successful. This example illustrates how critical the role of a strong leader is to the success of DHC projects.

The fourth speaker was Robert Brickner, a principal in Gershman, Brickner, and Bratton (GBB), a firm that specializes in resource recovery systems. According to Brickner, 99% of their business is with public sector clients wishing to solve waste management problems. Therefore, he views his job as helping his public sector clients to understand their options and make decisions. A "fair and reasonable" package for all parties involved should be the goal, he said. This means that costs, risks, and benefits must be allocated fairly between both public and private interests. The public sector must understand the competitive nature of the environment they are in, Brickner stated, and not expect private developers to be breaking down the door to develop their project. They

must package the project attractively and then convince the private partner they are serious about going forward. Many firms in the private sector have resource recovery know-how, but they must be attracted to the project. A problem in the 1987 market, Brickner sees, is that many businesses made their decisions in the 1982-83 timeframe. Those that didn't do it then are not likely to do it now. He believes there is a market there, but it is smaller and more selective than it was a few years ago.

SESSION 9: DHC'S ROLE IN THE STATE ECONOMY

Jay Holmes, director of DOE's Building Services Division in the Office of Buildings and Community Systems, was moderator for this session. He began by giving an overview of the current federal perspective on DHC. In its first budget request following Gramm-Rudman, the administration requested no funds for either feasibility studies or research on DHC. Congress, however, restored $900,000 for research but did not fund feasibility studies. The twelve cities currently performing Phase I Feasibility Studies were funded from 1986.

Unlike the European countries, a large market for district cooling systems exists in this country, Holmes stated. However, district cooling's competitive advantage is not as clear-cut as for district heating, and therefore Holmes believes feasibility studies and technology research are needed to make district cooling more competitive.

States are potential partners in the research and development of DHC systems in the future; particularly since oil overcharge money is a resource. DOE is planning regional meetings to explore how the capabilities of the national laboratories can be of assistance to states in this regard.

Holmes introduced the first speaker on the panel, Charles Baxter, Director of the DOE Support Office in New York City. He addressed the role of DHC in a state's economy. This role can have more or less significance depending on the specific characteristics of the state, Baxter said. In states with large population concentrations such as New York and New Jersey, the role is significant and growing. This is particularly true because of the heavy dependence on imported oil in these states.

For DHC to play an increasingly beneficial role in states' economies, Baxter stated, there first has to be a recognition by state governments that their economies are part of a larger national picture. In the 100 years from 1850 to 1950, the nation's energy use increased by 30 quads from 5 to 35 quads. In 20 years, from 1950 to 1970, the use doubled to 70 quads, followed by a price rise of more than sevenfold from under $5 per barrel to $35 per barrel in the seventies. Projections being made at that time indicated serious problems by 1990, particularly since over 62% of the known world oil reserves are in the politically unstable Persian Gulf area. Therefore, even though conservation efforts have almost halted growth of demand and alleviated short run price pressures, states with oil dependence should recognize this as a long term problem and be taking action to relieve and eventually eliminate this dependence, Baxter concluded. DHC is a beneficial strategy in these situations.

Solid waste landfills also are serious problems in densely populated areas, and trash is a potential fuel source already paid for, that can be used in DHC systems, Baxter asserted. Finally, since the price of other fuels follows that of oil, the inherent fuel efficiency benefits of DHC systems make them an attractive solution helping to stabilize the long run price and supply of energy in problem states.

The second speaker was Robert Gordon of New Jersey's Department of Energy, which was recently merged into the Department of Commerce and Economic Development. The state of New Jersey has been active in district heating and cooling system

development for several years. The state developed a master plan that set forth a policy addressing the history of consumption and dependence on certain types of fuels, particularly imported foreign petroleum. The central goals of the policy are: (1) to promote economic growth and safeguard the environment; (2) to encourage the lowest possible energy bills for all consumers; and (3) to assure an uninterrupted energy supply. Two major strategies to achieve these goals are to develop cost-effective energy management programs and to encourage cogeneration and DHC development, in order to reduce state reliance on energy imports and diversify energy resources.

DHC development in New Jersey began with the successful Trenton District Energy Project which has been in operation since late 1983. Newark and Camden are currently conducting Phase I Feasibility Assessment Studies as part of the DOE program with $10,000 contributed by the state as matching funds. Phase I Feasibility Studies for Jersey City and Hoboken are pending approval to use oil overcharge funds. Atlantic City is in the financing stage of system development using UDAG and EDA financing. Also, an RFP has been released soliciting proposals for cogeneration systems at ten state facilities.

The Department has been active in providing liaison and technical assistance to the cogeneration/district heating and cooling community, Gordon said. In 1985, the Department was instrumental in the passage of two bills beneficial to DHC development. The first provided for an exemption on the gross receipts franchise tax for natural gas for cogeneration and DHC facilities, and the second provided for an exemption from sales tax on equipment purchases. Golden concluded by saying that he foresees state involvement in cogeneration/DHC continuing as a part of the Governor's program of revitalizing urban areas and promoting economic development.

The third and concluding speaker for this session was Mary Losch-Gormley, Manager of the State of Minnesota District Heating Program in the Department of Public Service. The former Minnesota Department of Energy was recently merged with the Department of Public Service, which administers the oil overcharge funds, by executive order.

Gormley began by describing the pioneering Minnesota state program to assist and encourage DHC development. Five years ago, the legislature created a three-pronged program consisting of (1) Phase I and II study grants, (2) a design and construction loan program, and (3) technical assistance. In 1983, the grant program funded 12 Phase I Feasibility Assessment or "screening" projects at $20,000 apiece, and in 1984-85, 12 Phase II projects to develop preliminary designs and business plans were funded at $50,000 each. Since then, no Phase I or Phase II projects have been funded.

The design and construction loan program includes loans of up to 90% of the design and construction cost of a system, Gormley said. Activities that can be funded through the final design stage include final design and economic feasibility, heat source and customer contracts, project structuring, and financing. Construction loans are used for system installation, renovation, and customer conversion. The loans are backed by tax-exempt, state general obligation bonds with a current AA+ rating. To qualify, cities must demonstrate technical and economic feasibility, a sound business plan, and commitments. Repayment is flexible within a 20 year schedule. The types of projects that have been funded include expansion of existing

systems, conversion of a large system to hot water, solid waste-to-energy, and a new DHC system.

Gormley concluded with three examples of the 25 projects that have received assistance from the state program. The first example was Virginia City with a coal-fired municipal steam system and 3,100 customers. The system has a 45% line loss problem so conversion to hot water was contemplated, but a consultant study indicated an expenditure of $40 million would be required. A HUD/U.S. Conference of Mayors assistance team was sent in to review these results and now the project is on track with a phased development plan. The second example was Fergus Falls, which is planning to supply heat to a 22 building state hospital complex from two solid waste-to-energy plants. The contractual arrangements for this project in Duluth involved a donation by the Minnesota Power Company to the city of two retired boilers to supply steam to a new $400 million paper mill development. Thirty-nine million dollars would be required to rehabilitate the old boilers to coal and wood waste-firing.

SESSION 10: THE DHC/RESOURCE RECOVERY CONNECTION

The moderator for this session was Ron Musselwhite, Executive Secretary of the U.S. Conference of Mayors National Resource Recovery Association. The Conference of Mayors has had a long history of supporting both District Heating and Cooling and Resource Recovery Programs at the federal level because they both contribute greatly to solving urban problems, Musselwhite explained. Benefits are compounded when there is an opportunity to combine the two systems. This interconnection, and the attendant benefits, were the focus of this session. Both speakers in the session have had extensive experience in projects involving a linkage between DHC and resource recovery facilities.

Baltimore, Maryland has had a successful marriage of a district steam system and a resource recovery facility for the past two years, but the history of that combination dates to the early 1970's. Mike Gagliardo, Executive Director of the Northeast Maryland Waste Disposal Authority, related that the early history of developing a pilot pyrolysis plant on the site of the now existing resource recovery plant met with operating difficulties and was abandoned in 1979 after six years of unsuccessful attempts to make the plant reliable. His multicounty authority was formed at that time to help local governments solve the waste disposal crisis that had resulted, and plans were begun to develop the now existing waste facility.

Unfortunately, during that same period Baltimore Gas and Electric Company (BG&E), owners of the downtown steam system, had made a corporate decision to get out of the steam heat business and issued a moratorium on new steam customers just when downtown redevelopment was taking place. Thus many new potential steam customers made other energy systems choices.

When the new resource recovery plant was being designed, BG&E was again approached about buying steam from the plant. However, since BG&E was looking for a buyer for the steam system, it offered an unattractively low price for the steam. The resulting economics therefore favored development of an "electricity-only" waste-to-energy plant, but provision was made in the plant design to sell steam at a later date if the economics reversed.

In the early 1980's, the city of Baltimore applied for and received a HUD Phase I DHC feasibility study grant and subsequently a Phase II grant to further study ways to use thermal energy from the waste-to-energy plant. Various options were evaluated, and the original turbine design of the plant was modified for steam extraction. During this time, Baltimore Thermal Resources completed a purchase of the downtown steam system from BG&E and successfully negotiated to buy steam from the resource recovery plant. In January of 1986 steam began to flow to the downtown steam system, Gagliardo reported, to the mutual benefit of all parties. Thus, he concluded, when DHC and resource recovery can be combined it is Baltimore's experience that the benefits are certainly compounded. Baltimore Steam Company is now actively pursuing several of the HUD study recommendations for expanding the system.

The development of a 3,000 TPD resource recovery plant at New York's Brooklyn Navy Yard also has had a long history, explained Martin Gold. Gold, an attorney and partner in the firm of Brown and Wood, has represented the city in these negotiations since 1978, and the

plant has yet to be built. However, environmental permitting and financing should be completed this year, with construction scheduled to begin next year, Gold reported.

New York City, affectionately referred to as the Persian Gulf of Garbage, generates 23,000 tons of solid waste per day. An original study indicated the need for eight large resource recovery facilities. The Brooklyn Navy yard was selected as the best site for one, and plans were developed to supply steam to a neighboring existing Consolidated Edison steam plant with a tie-in to the city system. Universal Oil Products, later bought by Signal, was selected as the original contractor. The original study, conducted in 1981, compared three options: (1) steam only; (2) electricity only; and (3) cogeneration. The price of oil at the time was $30 a barrel and projected to go higher, and customers were still dropping off of the Con Ed steam system. Since that time, the price of oil has dropped, Con Ed has begun revitalizing the district heat system, and their steam business is now experiencing an increase. However, no new capacity is foreseen to be needed in this century. Therefore, the rate for steam sold to the system is almost entirely based on avoided fuel cost. Even so, steam has been chosen as the most economic option. Contracts with Con Ed have been agreed upon, and plans are proceeding.

SESSION 11: FINANCING DHC SYSTEMS: NEW TAX LAW, IDB'S, EQUITY PARTICIPATION, UDAG

The issue of financing DHC systems under the new tax law environment were discussed by the experts on the panel for this session. David Gatton, Director of Policy Analysis for the U.S. Conference of Mayors' National Resource Recovery Association introduced the panel. Under the new law DHC remains eligible for tax-exempt financing. However, the "cap" on the level of allowable state IDB financing has been reduced so approval in individual states becomes more of a political process. The investment tax credit has been eliminated, but is expected to be restored in 2-3 years.

Howard Winterson, an attorney with Energy Networks in Hartford, Connecticut, was the first speaker. He stated that a new $11 million expansion of the Hartford steam system around the capital was financed in 1986 with a 100% tax-exempt IDB. The state allocation was made in 1985, but Hartford applied for and received a carryover to 1986. They were also able to get an investment tax credit carryover. The IDB has a floating rate subject to monthly change, and the bond holders have the right to "put" each month. Therefore, a bank letter-of-credit was needed to back-up the bond holders. Fortunately a Hartford bank on the DHC system was willing to provide this service. Winterson advised bringing a bank into the DHC development process as early as possible.

The second speaker was Wallace McOuat, Principal in his own firm in San Francisco. Mr. McOuat believes that no DHC project will be "killed" by tax reform, but each will have to stand more on its own economics rather than tax shelters. The decline in interest rates will help DHC projects far more than the decline in oil prices has hurt, he believes. The lower tax rates will mean that the spread between taxable and tax-exempt debt interest rates will narrow, and municipal financing will become more difficult. The bigger risk is not financing, McOuat believes, but the up-front development costs that must be incurred before it is known whether a project is feasible. Therefore, it is in the early pre-development phases that there is justification for subsidies, he suggests.

The third speaker on the panel was William Mahlum, an attorney with his own practice in St. Paul, Minnesota. Mr. Mahlum represented the St. Paul District Heating Development Company during the design and construction phases of its large DHC system. While DHC is still eligible for IDB financing, he believes the political "Hassle factors" may not be worth the effort to get state approval to use it. he also sees more, not less restrictions becoming associated with tax-exempt financing. UDAG's, such as one used in St. paul, are very helpful but are becoming hard to get. The new tax bill has affected capital formation, and rule changes on limited partnerships have made leasing more attractive. Mahlum supports formation of an energy bank made up of bankers who understand energy systems. He believes DHC is inevitable, and sees large utilities getting back into private deals on these systems. Mahlum thinks it will be a while before all the ramifications of the new law will be sorted out and new opportunities identified.

SESSION 12: DHC ECONOMIC DEVELOPMENT CASES: MATURING SYSTEMS

Andrew Euston, Program Manager in HUD's District Heating and Cooling Program, was moderator for this session. He introduced the first speaker, Mr. Elliot Jennings of Resource Development Associates.

Mr. Jennings discussed hot water district heating using the city of Piqua, Ohio as an example. Piqua is located west of Columbus and is an old canal town. An early district heating system is now being used to carry telephone cable. As part of a community development program a new district heating system was built in Piqua. It began in 1976 and took about 5 years and 2 million dollars to construct. Changing a turbine in the municipal power plant to provide heat to the system cost about $1.2 million. Eight hundred and thirty-five thousand dollars were spent on a distribution system from the power plant to a hydroponic green house, the first and only customer at that time. The greenhouse failed and from there, enterprise zones were planned. With state funds being used, the economy started to come back. There are now 150 new jobs in Piqua in the enterprise zone. Half of the jobs are in the district heating area. Because of the block-grant work, the enterprise zone, the availability of land at a reasonable price, and energy at a reasonable price from district heating, several companies have chosen to locate in Piqua. The present district heating system will be extended soon, making the third expansion in four years. Machine tool operations, a propeller manufacturer, and a company which makes parts for the brake system on the space shuttle are some of the companies that have chosen to locate in Piqua.

The next speaker was Ralph Lynch, from the Pittsburgh District Heating Cooperative, a non-profit corporation with no Public Utility Commission jurisdiction. The corporation was formed by people who wanted to stay on a district heating system when Duquesne Light abandoned it in 1982, stranding about 115 customers. The fuel sources for the system are duel-fuel, gas- and oil-fired boilers. The ability to burn oil has been a significant factor in driving down energy costs in Pittsburgh. Steam is presently selling at $15.50 per thousand pounds. One out of three new buildings built in Pittsburgh is using the DHC system.

Mr. Lynch says he believes there is an institutional bias against district heating. In terms of economic development, Mr. Lynch doesn't think anybody is making a decision to locate in Pittsburgh on the basis of a district heating system, although it has been a successful and popular venture.

The next speaker was Rudy Brynolfson of the St. Paul District Heating Development Company (District Energy). As Brynolfson explained, District Energy in St. Paul was formed in 1979 as a non-profit corporation, with cooperation from the downtown building owners, local city government and state support. Federal funding was used for the design phase, begun in 1980. At the end of 1982 the system was financed, following the marketing and feasibility work. Mr. Brynolfson said that the financing of the project consisted of 2/3 revenue bonds and 1/3 HUD and the city. Repayment of the HUD money begins in the 1990's. Repayment of the city money begins in the 1990's with an indeterminate time frame for repayment based on where the corporation energy price is relative to gas prices at that time. The company financial statement reflects a deficit on an accounting basis, but the cash flow is positive and the business is stable. Since 1982 growth has been slow but steady.

The corporation has long-term 30-year contracts with its customers, 90 of whom signed up before the financing in 1982. Approximately 15 customers have been added every 2 years since that time.

Mr. Brynolfson said that it is difficult to document instances that indicate investment in St. Paul was made because of district heating. Addressing the issue of how district heating has been influenced by development, Mr. Brynolfson said that substantial redevelopment in St. Paul has been advantageous to district heating. The initial load was customers who came from the old steam system bought from Northern States Power in 1981. Initial marketing of the system was based on the payback from converting to a lower cost energy, since gas was going up 20% a year at that time. The seven year payback was enough to gain community support. Presently, with lower gas prices, it is more difficult to make the case for converting an existing boiler system for energy savings alone.

According to Mr. Brynolfson, the focus of district heating in St. Paul has been on both new development and redevelopment. Industrial parks, new buildings, and renovations have been sites for adding to the district heating system. Efforts of the development authorities of the city, the city planning and economic department and the city Port Authority have supported the development with the company. The Port Authority is the developer of the industrial park to which district heating has been extended, as well as the financier. Mr. Brynolfson believes that the future success of the company will depend on the marketing that is done and the development that occurs.

The concluding speaker for this session was Mayor Stephen Carlson of Jamestown, New York. Mr. Clark stated that the first hot water cogeneration district heating system in New York State was constructed in Jamestown in 1984 - a small $800,000 pilot system supplying hot water from the city's electrical power generating plant to four nearby buildings. Because of the success of the system, primarily in dollars saved to customers on space heating bills, it was decided that the building of a full district heating system extending to the central district should be initiated. Presently, the community-wide energy system has 19 customers, with a peak load of 13 megawatts thermal. Jamestown received funding from the New York State ERDA for the early planning process.

Mr. Carlson said that he thinks the system has become a very viable economic development tool for the future. Mr. Carlson believes that new development is taking place partially because of district heating and the costs that can be saved on energy. It is certainly a large element in a building owner's decision to proceed with new construction. A new apartment complex and a three-story office complex (bringing about 150 new employees), represent examples of the economic development.

The city's present system supplies about 65 billion Btu's of district heat per year and is selling about 44 million Btu's of thermal energy an hour. The present cost is $7.50 per million Btu's. Mr. Carlson explained that these costs are lower than had been previously estimated. The present price for natural gas in Jamestown is $5.20 per million Btu's. For an average boiler efficiency of between 60% and 65%, this represents a cost of about $10.00 per million Btu's.

Mr. Carlson cited some of the reasons for the success of district heating in Jamestown. The coal-fired power plant, the base source for the energy - is municipally owned. Coal is the least expensive source of energy obtainable. There is a very dense core for the heat load within close proximity of the heat source. The district heating division contracts the operation of the system through the electrical or water division of the plan as opposed to a new staff. The successful operation of a pilot system showed the potential cost savings, serving as a valuable marketing tool. Engineering analysis for conversion of buildings to district heating was provided free of charge to potential customers.

SESSION 13: INTERNATIONAL TRENDS

The focus of this session was to put DHC development in a world context by exploring trends in several other countries. Floyd Collins, DHC program Manager with DOE, was the moderator for this session. He and Wyndham Clarke of HUD are the designated U.S. Representatives to the District Heating Task Force of the International Energy Agency (IEA). The IEA DHC Committee meets every six months to exchange technical information. Mr. Collins reported on the last meeting in Winnepeg, Canada, where a 5 MW heat-only, packaged nuclear reactor is under development for sale to world markets.

The first speaker was H.C. Mortensen, President of the Copenhagen District Heating Company and Chairman of the IEA District Heating Task Force. Mr. Mortensen compared DH (No "C" in Denmark) development in Denmark and the United States. Although he had no clear explanation, somewhere along the development path Denmark decided to merge electric power and heat production, in what is commonly termed combined heat and power systems. Although originally this was also the case in the U.S., conditions gradually changed and separation of heat and power production became common. Systems in the U.S. were privately owned and district heating became a small secondary part of the larger electrical business, whereas in Denmark district heating was more often the business of municipalities and consumer cooperatives.

The energy crisis of the 1970's led the Danish Government to establish a goal of oil import independence. A national heat plan was prepared, followed by a heat planning act which required each of the 275 municipalities in Denmark to prepare a heat plan. The heat plan process divided each municipality into heat districts which would be designated for district heating, natural gas, or other forms of energy supply. The goal of this program was to have greater than 70% of the country heated by DH or natural gas from Denmark's North Sea supply by the year 2000. It is anticipated that $500 to $1000 per capita will be spent on DH development annually through the year 2000.

The inherent policy of this program is to try to use "free" energy from cogeneration and municipal refuse whenever possible before burning other fuels. Fuels, particularly oil, are heavily taxed to discourage their use. Even so, the average danish home spends roughly the same ($1300) on heating as an equivalent home in the northern U.S. Negotiations between electric companies and heat transmission companies have resulted in a 10-15 year "grace" period during which heat consumers pay only the marginal cost of the energy supplied to the transmission and distribution system. This allows time for the DHC system development cost to be paid back. After this period, the benefits are shared equally. A similar arrangement is made with resource recovery plants. This policy, which has led to a high fuel use efficiency and large cost reductions, along with North Sea oil and gas, now allows Denmark to be free from world oil price fluctuations. The future of DH in Denmark and all of Europe looks bright, said Mortensen, with a forecast of a doubling by the mid 1990's.

Ishai Oliker, DHC Project Engineer with Burns & Roe, next discussed some of the work his firm has been doing with China and South Korea. In Northern China, where the climate is similar to New York, the primary heating fuel is coal.

Because 50% of building heating is from small stoves and 46% is from small boilers, pollution in Peking is particularly bad. Coal transport is also difficult and expensive, so Peking is beginning to develop district heating systems. Currently, 11% of electric production is produced from cogeneration plants, mostly of 50 MW or less. A new 300 MW plant is being designed, and larger boilers are replacing smaller ones in large buildings, Oliker said. Low-temperature heat-only nuclear reactors are also under development. Seoul, South Korea, has a population of 10 million people, most of whom live in high rise apartments built in the late 1950's and 1960's. In 1979, the city began to pursue DHC and will have a 300 MW cogenerating refuse plant on line this year. An existing 400 MW plant is also being retrofitted for cogeneration and district heating. Burns & Roe has helped the city with a master plan for the future, calling for a 1400 MW plant, and a total interconnected load of 2500 MW.

Gordon Bloomquist, of the Washington State Energy Office, has spent a considerable amount of time studying Swedish district heating systems. DH development did not begin in Sweden until the early 1950's. Now there are 114 systems with the five largest comprising 40% of the total heat supply. Cogeneration is used along with fluidized bed combustion to burn high sulphur coal in an environmentally acceptable manner. Approximately 20 systems are linked to resource recovery. The trend in Sweden, according to Bloomquist, is now toward lower temperature systems with large-scale heat pumps in the 20-30 MW range. The heat pumps raise the temperature of geothermal well water, sewage waste water, lakewater, and seawater up to 180-190°F. In 1981, the city of Lomb generated 100% of its space heating with oil. In 1986, over 90% of its heat requirement was supplied by heat pumps in the district heating system. Large open-plate heat exchangers along with shell-and-tube heat exchangers are being used in the large systems where three or four units are linked in series. The open-plate heat exchangers assist the sewage treatment process by removing nitrogen and adding oxygen to the effluent, Bloomquist noted. The trend to increased use of heat pumps is aided by relatively inexpensive nuclear and hydropower electricity available in Sweden.

SESSION 14: PROGRESS IN HOUSING AND PUBLIC HOUSING

Nancy S. Chisholm, Director of the Policy Staff in Public and Indian Housing, HUD, chaired this meeting. She indicated that the Office of Public and Indian Housing is studying the effects of its regulations on housing authorities' incentives for making energy improvements.

Gregory A. Hansen, an Energy Specialist with the Chicago Housing Authority (CHA) reported on the activities of CHA in community energy systems. As a recipient of the latest round of HUD funding for Phase I Feasibility Studies, the city of Chicago and CHS have reevaluated their needs in energy production, employment, project-wide retrofit and rehabilitation of aging structures and systems. The study area covers approximately seven square miles south of the Chicago Loop. This area is composed of residential, commercial, institutional and industrial zones and includes seven major CHA developments with 242 low medium and high-rise buildings comprising 12,000 apartments and a population of 45,000 people. Other public facilities include a major police station and 4 or 5 high schools with about 4,000 students.

The private sector includes two major hospital centers, a major publication center and international office headquarters, the campus of Illinois Institute of Technology, and one of the nation's largest exposition centers, McCormick Place. With such a large potential for private sources and end users, CHA felt it was imperative to directly involve these institutions in the study, so as to "marry" them to the project. This would directly affect their capital expenditure and financial planning decisions.

Another method for assuring success of a project is the involvement of the local community planning and interest groups. This link will enable the study team to define any negative reactions in the community, educate and reassure through their representatives, make known the benefits of the project to the community, and resolve any safety and environmental concerns. The Advisory Group is a comprehensive collection of industrial, financial, technical, governmental, and community representatives focused on defining and overcoming the problems for the successful completion of the project.

Potential heat sources include five Housing Authority heating plants with a generating capacity of 700 million Btu per hour. These plants all have campus underground distribution systems. R.R. Donnelly has a major heating plant with an intricate underground, tunneled distribution system. Similarly, Michael Reese Hospital and Illinois Institute of Technology have major heating plants with tunneled underground distribution systems. Also within the area is a Commonwealth Edison power plant. This is a coal-fired plant which is used sparingly, mainly in high-demand situations. Waste heat is dumped into the Chicago River. Finally, there is a proposed refuse-fired DHC plant to the near west of the area. This is the Stockyards Project, which is currently awaiting city approval. The proposed plant will burn 450 tons of municipal solid waste per day and generate approximately 140,000 lbs. of steam per day.

Staged implementation of DHC in Chicago is a planned concept to strengthen the confidence and display the benefits of a fully-operational alternative power source available to the communities.

Chicago DHC projects begin with Phase I, the retrofit and tightening-up of the existing sources, distribution systems and end users, and the conversion of all steam heating systems to hot-water systems.

Once these plants and buildings are retrofitted and converted, the concept of district heating can be employed by the creation of specific DHC "islands" in Phase II of the project. These islands are service areas within the target study area that can be interconnected internally. Subsequent phases of development will interconnect the separate islands, permitting shunting of energy between them to maximize efficiency. The final phase of DHC development would entail construction of an efficient central power plant.

In conclusion, the CHA and the city of Chicago have united to make DHC an attainable concept. Already there are projects underway to provide district energy, rehabilitate underground distribution systems to comply with a low-temperature thermal medium, and to rehabilitate existing buildings from steam to hot water.

Creighton Lederer, Director of Detroit, Michigan's Building & Safety Engineering Department, spoke on Detroit's activities in community energy systems. Detroit's major system, owned by the Detroit Edison Company, is located in the southern part of the center of the city near the Detroit River. Built in the early 1900's, the system incurs high maintenance costs. Detroit Edison's competitor, Michigan Consolidated Gas, supplies the fuel for most of the system.

The City of Detroit owns another small DHC system that serves a hospital, the jail, and several other buildings. The city has not determined the future of this system in light of changes to the larger system.

Detroit has three main thrusts in its activities with the Detroit Edison system:

1. Have a stable user for the heat from the waste incineration plant the city is developing;
2. Heat the large number of public housing units in the area; and
3. Find new customers for the system.

Mr. Lederer gave some details of Detroit's refuse incinerator. The capacity is 3,0000 tons per day. Energy production from the incinerator will be 65 megawatts of electricity for sale to Detroit Edison, and 500,000 pounds of steam per hour. This joint project of Detroit and Highland Park is bonded at one-half billion dollars. The plant is now under construction and will come on-line in 1989. A steam line will go south from the incinerator to the Detroit Edison plant. The refuse plant was controversial, and several challenges were made to its construction. The city has won the right in court to build the plant, however.

The main public housing project in the area is Jefferies, which has 2,200 units currently heated by gas-fired boilers. The heating needs of this complex can be easily supplied by the Detroit Edison system. This will eliminate a considerable operation and maintenance expense. HUD has a grant with the city of Detroit to study the connection of Jefferies to the DHC system. Detroit has hired a consultant to study the problems associated with this connection.

Charles Clinton of the Washington, D.C. Energy Office spoke about his program. The D.C. Energy Office has a HUD grant to study DHC in the city's public housing system, which has 12,000 public housing units in 55 buildings. The current

heating bill is $10,000,000 a year, and DHC could mean a 30 percent savings in energy costs in the area that has been targeted for DHC development.

A 1500 ton per day incinerator is located on Benning Road, but only 900 tons of this capacity are used. The city's contractor, Burns and Roe, is studying use of this plant. By retrofitting this plant and adding cogeneration, they hope to be able to heat about 1,300 units of public housing within a half mile radius of the plant.

Washington, D.C.'s DHC activities are only one part of a larger comprehensive energy plan. Conservation is a significant part of this plan. The city wants to keep funds now spent on energy within the city. Implementation of 48 different measures within the plan will produce a 6 to 7 percent savings over present spending.

SESSION 15: MAYORS' LUNCHEON SPEAKER PANEL

An enthusiastic concluding session to the 5th DHC conference was given by the mayors of five cities engaged in DHC projects. J. Michael Dorsey, HUD Assistant Secretary for Public and Indian Housing, introduced the mayoral speaker panel.

Leading off was Mayor Art Holland of Trenton, New Jersey. The mayor is particularly proud of Trenton's cogeneration district heating and cooling system, which is the first modern system of its kind in an urban setting in the country. The DHC system, developed in the early 1980's with assistance from DOE and HUD, serves the state capitol, municipal buildings, a prison, a major medical facility, and many other buildings in the downtown nd nearby areas, including the oldest Catholic parish in Trenton. By replacing 20 or more old boiler systems with one modern plant equipped with the best available environmental control technology, the environment has benefitted substantially, said Holland. The cost savings and price stability provided to DHC customers has proved to be a spur to the economic revitalization taking place in downtown Trenton. In city hall alone, over $2 million in heating costs will be saved in the next 20 years. District heating and cooling systems such as the one in Trenton move the United States toward the goal of energy self-sufficiency. Holland urged that we not lose sight of this important national goal.

Mayor Richard Neal of Springfield, Massachusetts, carried Mayor Holland's plea one step further by stating it was the responsibility of public leadership to keep the energy issue constantly before the public. We as a nation and in our individual cities should not be lulled into a sense of false hope that the energy crisis has disappeared. It is public leadership that must create stability in the energy market because there is none in the Middle East, stated Neal. In his city of Springfield, development of a downtown district heating system is underway that will serve the municipal buildings complex and the civic center. Recently, four bids were received to develop a $125 million downtown hotel complex. The city, he said, is in a position to bargain with these developers to insist they use the district heating system. Ten years from now, the DHC system will be linked to use heat from a resource recovery facility now under construction. Neal is convinced that it is this kind of foresight and public leadership that will pay dividends. He concluded by thanking HUD and DOE for providing the necessary leadership at the federal level to unify local efforts and for providing a forum for exchange of ideas and experiences.

Developing a stable system that can supply energy independent of volatile foreign sources was part of the reason that Jamestown, New York decided to develop a DHC system, according to Mayor Steven Carlson. The other reason was that it made good economic sense. The key, said Carlson, is to start small and expand the system on a pay-as-you-go basis. Jamestown was fortunate to have a municipal coal-fired power plant that could be used as a cogenerating heat source. The system is currently in the third heating season with annual revenues exceeding $600,000. Carlson is proud of the fact that the $4.8 million capital cost has been locally financed without a government subsidy. Selling energy at $7.50 per million Btu generates annual savings to the customers of 35%-50%. Thus, Carlson sees the dual advantages of a secure energy supply and attractive economics that are becoming apparent to DHC customers. This year he expects the

Jamestown system will expand to an industrial corridor and create a new "heat island" for future expansion.

The city of Camden, New Jersey is initiating its first DHC feasibility study as a result of being awarded a DOE grant. Mayor Melvin Primas sees the potential benefits of district heating as an economic development tool for his city. An industrial park development has been located on the site of an abandoned Navy shipyard. A resource recovery plant site has also been selected nearby, making a link between the two via a DHC system appear to be an attractive possibility. Public housing units are in the area with 40 year old boiler systems that need replacement. A DHC system could also serve these units, Primas said. Sufficient emphasis is being placed on the outcome of the study that the mayor has appointed the director of public utilities as the project manager. Primas sees DHC as a way for cities to manage future energy costs.

Boise, Idaho has had geothermal heating since 1892, said Mayor Dirk Kempthorne. In 1979 the city initiated a $6 million expansion loop to 26 downtown buildings totaling over one million square feet and including the city hall, library, senior citizens center, and firehouses. The system is in its fourth year of operation. It has a capacity of 4,000 gpm at 170°F, but only 20% of this capacity is currently utilized. The original selling price of the energy was tied to competitive fuel prices, so margins are getting thin, said the mayor. Aggressive marketing is needed to keep the system expanding. A $1 million demonstration grant has been awarded to the city by DOE to tie the university into the system.

The concluding speaker on the mayors' panel was Douglas Henning, the Mayor of Renville, Minnesota. Renville is a rural farm community with a sugar beet factory with 10,000 gpm of 140°F water as a potential heat source. Unfortunately, a 2-mile run to the town center proved unfeasible. Currently, the community is trying to locate a farm related industry such as a fish farm or greenhouse to help lower the cost of the supply line.